



USAID
FROM THE AMERICAN PEOPLE

TECHNICAL REPORT

KHUMBU LOCAL ADAPTATION PLAN FOR ACTION (LAPA)

SAGARMATHA NATIONAL PARK AND BUFFER ZONE
SOLU-KHUMBU DISTRICT, NEPAL



JANUARY 2015

This publication is made possible by the support of the American people through the United States Agency for International Development (USAID). It was prepared by Engility Corporation and The Mountain Institute.

This report has been prepared for the United States Agency for International Development (USAID), under the Climate Change Resilient Development Task Order No. AID-OAA-TO-11-00040, under The Integrated Water and Coastal Resources Management Indefinite Quantity Contract (WATER IQC II) Contract No. AID-EPP-I-00-04-00024.

Engility Corporation Contact:

Glen Anderson, Chief of Party, Glen.Anderson@EngilityCorp.com

Engility Corporation

1320 Braddock Place

Alexandria, VA 22314

Cover Photo: Alton C. Byers, The Mountain Institute

KHUMBU LOCAL ADAPTATION PLAN FOR ACTION (LAPA)

SAGARMATHA NATIONAL PARK AND BUFFER ZONE
SOLU-KHUMBU DISTRICT, NEPAL

January 2015

Prepared for:

United States Agency for International Development

Global Climate Change Office, Climate Change Resilient Development project

Washington, DC

High Mountains Adaptation Partnership

Prepared by:

Alton C. Byers

The Mountain Institute

Washington, DC

and

Shailendra Thakali

The Mountain Institute

Washington, DC

Editorial assistance: Glen Anderson, Jonathan Cook, Michael E. Cote, John Furlow, Meghan Hartman, Daene McKinney, John Harlin, Bheem Rai, Ang Rita Sherpa, Phurba Sherpa, Dambar Thapa, and the people of Sagarmatha National Park and Buffer Zone, Nepal; and reviewers, Phanindra Kharel (Deputy Director General, DNPWC) and Ram Chandra Kadel (former SNP Warden)

Contact: Michael E. Cote, Engility Corporation, Michael.Cote@EngilityCorp.com

DISCLAIMER

The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government

TABLE OF CONTENTS

1.0 BACKGROUND	8
1.1 USAID and the High Mountains Adaptation Partnership	8
1.2 NAPAs, LAPAs, and the Government of Nepal	8
1.3 The Setting: Khumbu	8
2.0 PROCESS	10
2.1 The Khumbu LAPA Framework	10
2.2 The Climate Change Sensitization and Adaptation Planning Process	10
2.3 Participatory Tools and Techniques Used In Khumbu LAPA	13
3.0 THE STEPS	14
3.1 Step 1 — Assessment of Development Needs and Climate Change Awareness Building	14
3.2 Step 2 — Vulnerability and Adaptation Assessment	14
3.2.1 Trekking and Mountaineering	15
3.2.2 Lodges	15
3.2.3 Lives and Livelihoods	15
3.2.4 Transportation	15
3.2.5 Airport	16
3.2.6 Seasonal Trade	16
3.2.7 Communication and Hydropower Infrastructure	16
3.2.8 Services	16
3.2.9 National Park and Biodiversity	16
3.2.10 Drinking Water	16
3.3 Step 3 — Vulnerability Assessment	16
3.3.1 Glacial Lake Outburst Floods (GLOFs)	16
3.3.2 Landslides	18
3.3.3 Heavy Snowfall	19
3.3.4 Windstorms	20
3.3.5 Forest Fires	20
3.3.6 Floods	20
3.4 Step 4 — Adaptation Plan Development	21
3.5 Step 5 — Integrating the Adaptation Plan into the Local and National Planning and Funding Mechanisms	22
3.6 Step 6 — Implementing the Plan	22

TABLE OF CONTENTS

4.0 STEP 7 – NEXT STEPS AND LAPA MONITORING	24
5.0 CONCLUSIONS AND LESSONS LEARNED	25
5.1 Community Consultation Processes are Expensive and Time Demanding	25
5.2 Build Formal Relations with Government and Community Partners at the Beginning of a LAPA Program	25
5.3 Establish Trust and Partnerships with all Stakeholders	25
5.4 Integrate Development into the LAPA Process	26
5.5 Use Larger Geographical Units	26
5.6 Incorporate Scientific Data	26
5.7 Build In-Country Capacity	26
5.8 Share Data and Information	26
5.9 Include a Media and Outreach Component in Project Design	26
5.10 Nurture the Community of Practice	27
REFERENCES	28

Note: This document is a summary of the complete Khumbu Local Adaptation Plan for Action (LAPA), available from <http://highmountains.org/content/khumbu-lapa-complete-reference-document>.

The complete LAPA contains descriptions of the key methods, processes, findings, results, and materials used in a series of community consultations and district-level meetings held between September 2012 and December 2013. It is meant to serve as a supplementary resource document to this condensed Khumbu summary LAPA.

ACRONYMS

BZ	Buffer Zone
BZC	Buffer Zone Committee
BZFUGs	Buffer Zone Forest User Groups
BZMC	Buffer Zone Management Committee
CCFGORRP	Community-Based Flood and Glacial Lake Outburst Risk Reduction Project
CoP	Community of Practice
DADO	District Agriculture Development Office
DDC	District Development Committee
DFO	District Forest Office
DHM	Department of Hydrology & Meteorology
DIO	District Irrigation Office
DLDO	District Livestock Development Office
DNPWC	Department of National Parks & Wildlife Conservation
DSCO	District Soil Conservation Office
GLOF	Glacial Lake Outburst Flood
GoN	Government of Nepal
GPR	Ground Penetrating Radar
HiMAP	High Mountains Adaptation Partnership
KACC	Khumbu Alpine Conservation Council
LAPA	Local Adaptation Plans for Action
LDO	Local Development Office
M&E	Monitoring and Evaluation
MoTCA	Ministry of Tourism & Civil Aviation
MoU	Memorandum of Understanding
NAPA	National Adaptation Programme of Action
NMA	Nepal Mountaineering Association
NTNC	National Trust for Nature Conservation
SNP	Sagarmatha National Park
SNPBZ	Sagarmatha National Park and Buffer Zone
SPCC	Sagarmatha Pollution Control Committee
SWC	Social Welfare Council
TAAN	Trekking Agencies' Association of Nepal
TMI	The Mountain Institute
VDC	Village Development Committee
UGs	User Groups
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
WWF Nepal	World Wildlife Fund Nepal

LIST OF FIGURES

Figure 1: Sagarmatha National Park and Buffer Zone.

Figure 2: LAPA community consultation at Namche Bazaar.

Figure 3: The Imja glacial lake (top) began forming in the early 1960s, and now contains approximately 65 million cubic meters of water.

Figure 4: In the event of a glacial lake outburst flood, downstream villages situated close to the Dudh Kosi river channel, such as Phakding above, would suffer enormous damage. The continued construction of tourist infrastructure upon previously uninhabited river terraces complicates the issue.

Figure 5: Landslide damage at Ghat.

Figure 6: Extreme snowfall events can create added hardship for porters who often lack warm clothing, appropriate equipment, or life insurance.

LIST OF TABLES

Table 1: Summary of LAPA Implementation Steps in the Khumbu Region of Nepal.

Table 2: Participatory Tools and Techniques Used in Khumbu LAPA.

Table 3: Climate Change Impacts and Adaptation Project Priorities.

1.0 BACKGROUND

1.1 USAID and the High Mountains Adaptation Partnership

Climate change is one of the most important global environmental challenges facing humankind, and local communities living within mountainous regions are particularly vulnerable as temperatures rise, glaciers recede, new glacial lakes form, and weather becomes less predictable. Despite this, understandings of the human dimensions of climate change are still in their infancy in mountain regions where there is limited information about climate change impacts, community vulnerabilities, and adaptation options. In response, the United States Agency for International Development (USAID)-funded High Mountains Adaptation Partnership (HiMAP) was established in March 2012 with the objectives of providing people living in remote areas with a voice in the current dialogue surrounding high mountain climate change risks; establishing a Community of Practice (CoP) that strengthens communication and collaboration between scientists and practitioners globally; fostering the next generation of “Climber-Scientists” capable of blending the best of sophisticated technologies with traditional field-based methods; and increasing global awareness for the importance of high mountain glacial watersheds in general. A fundamental service of the HiMAP in Nepal was the facilitation, over a two-year period, of the Local Adaptation Plan for Action (LAPA) for the Khumbu region.

1.2 NAPAs, LAPAs, and the Government of Nepal

The Government of Nepal (GoN) initiated climate adaptation planning and implementation with the National Adaptation Programme of Action (NAPA), endorsed in September 2010. The NAPA describes the GoN’s intention to disburse at least 80 percent of the available budget earmarked for climate change directly for local implementation of identified adaptation actions. The NAPA also aims to ensure that national adaptation planning supports adaptation by local communities, particularly the climate-vulnerable poor.

Recognizing the enormous variability within Nepal and within its various communities, in 2011 the GoN developed the Local Adaptation Plans for Action (LAPA) framework. The LAPA framework is designed to more fully reflect the needs and aspirations of Nepal’s diverse communities, as well as the wide range of impacts experienced from climate variability. It is an important framework that strengthens mountain community understanding of climate change, local assets, vulnerabilities, prospective solutions and adaptation strategies, funding mechanisms, and priority action plans.

1.3 The Setting: Khumbu

The 1,423 km² Sagarmatha National Park and Buffer Zone (SNPBZ) is located in northeastern Nepal in the Solu-Khumbu District of Sagarmatha Zone (Figure 1.1). The park is roughly triangular in shape and bounded by mountain peaks in excess of 6,000 m, including the world’s highest, Mt. Everest at 8,848 m. The region is particularly vulnerable to climate change impacts because of its extreme topography, remoteness, lack of transportation facilities, and tourist-driven and dependent economies. Khumbu is the traditional home of the Sherpa people, formerly agro-pastoralists and traders whose economies are now dominated by the adventure tourism trade (trekking and climbing). The total population of the Khumbu region in 2012 was 7,161.

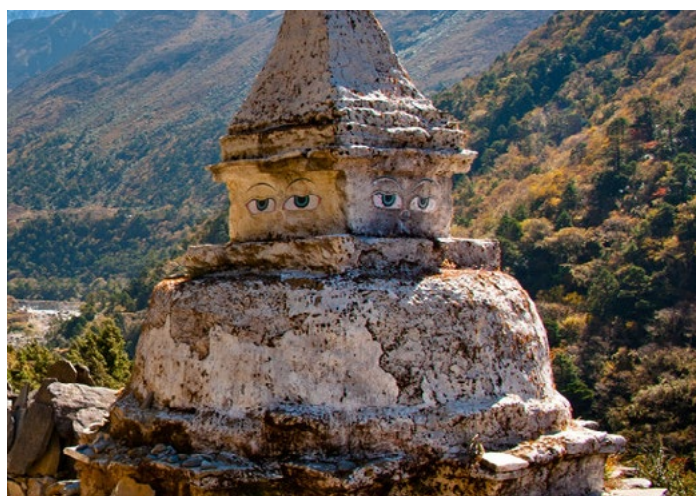




Figure 1: Sagarmatha National Park and Buffer Zone.

2.0 PROCESS

2.1 The Khumbu LAPA Framework

The standard GoN LAPA framework consists of seven steps for integrating climate change resilience into local-to-national planning processes. These steps were modified by HiMAP staff to include a greater emphasis on achieving development goals in the context of climate change, reflective of USAID's Climate Resilient Development Framework, as well as incorporation of resultant adaptation programs into existing planning and decision-making processes, also known as "mainstreaming." The resultant Khumbu LAPA framework includes the following steps:

1. Assessment of development needs and climate change awareness building
2. Assessment of assets, vulnerabilities, and adaptation mechanisms
3. Prioritization of adaptation options
4. Development of the LAPA
5. Integrating and mainstreaming the LAPA into local planning processes, decision-making, and funding sources
6. Implementing the LAPA
7. Monitoring and evaluation of the results and impacts of the LAPA

2.2 The Climate Change Sensitization and Adaptation Planning Process

The Khumbu LAPA is based on the key findings and results of three separate community consultation meetings and workshops held in the Khumbu in September 2012, April 2013, and September 2013; two smaller meetings in Kathmandu in December 2012; district level meetings in Salleri in March 2014; and mainstreaming meetings in SNP and Salleri during September through December 2014 (Figure 2). Concurrently, detailed field investigations of Imja Glacial Lake were conducted by HiMAP scientists regarding the lake's depth, volume, growth rate, risks, and risk reduction strategies. Results were shared with local communities and during LAPA consultations on a regular basis. Consultation time frames and sequences of steps followed are shown in Table I.





Figure 2: LAPA community consultation at Namche Bazaar.



Table 1: Summary of LAPA Implementation Steps in the Khumbu Region of Nepal.

LAPA Step	Timeframe	Steps of the LAPA Framework
1	September 2012-April 2013	Assessment of development needs and climate change awareness building: workshops in Chaurikharka, Namche Bazaar, and Dingboche. Facilitated discussions of: Assets; Vulnerabilities; Introduction to climate change; Adaptation actions to minimize vulnerability. Two follow-up meetings in Kathmandu with Khumbu residents held in December 2012 and March 2013.
2-3	April-September 2013	Assessment of assets, vulnerabilities, and adaptation mechanisms: Prioritization of adaptation options; consultations conducted in Thame, Phortse, and Dingboche villages in addition to Chaurikharka and Namche Bazaar.
4	September–December 2013	Development of the LAPA: Consolidating steps 1-3. LAPA draft finalized by US and Nepal HiMAP teams.
5	December 2013-April 2014	Integrating LAPA into local planning processes, decision-making, and funding sources: meetings with District Soil Conservation Office (DSCO), District Irrigation Office (DIO), District Development Committee (DDC), District Agriculture Development Office (DADO), District Livestock Development Office (DLDO), District Forest Office (DFO), Local Development Office (LDO), Himal Project Office; half-day consultations with GoN officials and local people held; LAPA endorsed with plans to fund several adaptation options in 2014.
5-7	May-September 2014	Integrating LAPA into local planning processes, decision-making, and funding sources: original May mainstreaming consultations had to be postponed due to lack of MOU between DNPWC and TMI for HiMAP. May presentations on HiMAP progress (LAPA and Imja research), Everest Alliance field assessments, and Imja lake field research continued as planned.
5-7	September-December 2014	Integrating, implementing, and monitoring the LAPA: Letter from DNPWC received and mainstreaming consultations began; final Khumbu LAPA shared with communities for feedback; identification of overlapping projects between LAPA and SNP Management Plan; development of next steps needed for implementation of the 22 LAPA priority projects identified as overlapping with SNP Management Plan; partially funded development of 9 BZ community forest operational plans for Chaurikharka VDC. The plans incorporate adaptation options as identified in the Khumbu LAPA that are directly related to forest conservation. Development of Monitoring and Evaluation (M&E) guidelines; visited Village Development Committees (VDCs) to discuss results of the mainstreaming consultations and next steps; final English and Nepali Summary LAPAs formatted, published, and distributed.

2.3 Participatory Tools and Techniques Used In Khumbu LAPA

The HiMAP Khumbu LAPA used eleven (11) participatory tools and techniques for the community consultations (as illustrated in Table 2):

Table 2: Participatory Tools and Techniques Used in Khumbu LAPA.

Tools	Techniques (and outcomes)
Social map	Records settlements, villages, trails, bridges, services, forests, agricultural areas, development activities and other prominent features
Vulnerability map	Records villages, communities, forests and agricultural areas that have been or are prone to climate-induced hazards such as flooding, forest fires, GLOFs, windstorms, snowfall, drought and agricultural pests and diseases
Seasonal calendar	Analyze the local climate change experience in recent years. The experience is recorded using a monthly calendar and compares past experience with the present across climate variables
Historical time line analysis	Analyzes the occurrence and frequency of different climate-induced hazards during the past three decades and their impacts on communities, villages, agricultural and forest land, and infrastructure
Affected areas/households analysis	Records the impacts of climate-induced hazards on villages, households and socio-economic groups based on social and vulnerability maps and historical time line analyses
Climate-induced hazards ranking and impact analysis	Analyzes hazards identified in the vulnerability map and the impacts of these on different sectors. A scale of 0–4 was used to score the local experience of intensity and the extent of the impacts on different sectors. This process records the ranking of various hazards in terms of their impacts on sectors that have been the most affected
Climate change impacts on different sectors	Analyzes the present and potential impacts of climate change on different priority sectors as identified in the climate change ranking and impact analyses
Adaptation visioning	Records the impacts of the six most significant hazards as ranked and prioritized by climate change ranking and impact analysis tools
Adaptation prioritization	Records different adaptation programs and activities using four criteria (effectiveness, cost-effectiveness, feasibility and target group orientation) and prioritizes them. A scale of 0–3 was used to score each criterion
Stakeholder analysis	Records and prioritizes different organizations and institutions, governmental and non-governmental organizations and the private sector using a Venn diagram. This tool helps define the significance and importance of climate adaptation plans as well as the roles and responsibilities of each organization
Implementation plan	Based on adaptation prioritization, a detailed implementation plan of action is developed. The plan includes the top six identified hazards, the adaptation activities and their ranking in terms of importance and priority, possible funding sources and responsible organizations

3.0 THE STEPS

3.1 Step 1 — Assessment of Development Needs and Climate Change Awareness Building

A range of participatory tools were used to facilitate three two-day introductory consultation workshops in Phakding, Namche, and Dingboche. The first day of the workshop included an assessment of assets that are important for local livelihoods, followed by a discussion of local development needs. A power-point presentation covering the basics of climate change and vulnerability was used wherever electricity was available. Specially prepared posters and meta cards were used to facilitate discussions on the current and likely impacts of climate on important local assets. A seasonal calendar was used to document the agricultural cycle as well as to identify contemporary climate change impacts on different crops. Flip charts were used to record the participants' ideas and suggestions regarding local adaptation capacities, practices, and options to reduce climate change vulnerability and risks.

The major identified climatic stressors included:

- Temperature increases
- Glacial recession
- Increase in the number of potentially dangerous glacial lakes
- Climatic vulnerability
- Increased incidence of forest fires, flooding, and landslides

Non-climatic stressors to climate change included:

- Deforestation (decreasing the cooling effects of continuous vegetative cover)
- Contaminated freshwater supplies (from landfills, improper septic tank construction, and raw sewage disposal)
- New diseases and insects leading to increased crop failure

3.2 Step 2 — Vulnerability and Adaptation Assessment

A multi-criteria ranking was used to assess the impacts of nine climate hazards upon 26 different sectors identified as being important for the Khumbu region. A scale of 0-4 was used to score each hazard or impact, with 0 implying no impact, 1 low impact, 2 moderate impact, 3 high impact, and 4 very high impact. The mean scores from three VDCs were used to determine those sectors most sensitive to climate hazards, ranking the hazards in descending order, from highest to lowest.

In order of perceived potential impact, the most important hazards identified by participants included the following. Of these, participants chose the first six as top priority for developing adaptation strategies:

1. GLOFs
2. Heavy snowfall
3. Windstorms
4. Landslides
5. Forest fires
6. Floods

Similarly, the sectors that were considered to be the most vulnerable to climate-induced hazards included:

1. Porters
2. Biodiversity and agriculture
3. Livestock
4. Sagarmatha National Park
5. Hydropower facilities
6. Lodges
7. Human health
8. Trekking and mountaineering (including associated drinking water systems and trails)
9. Bridges
10. Schools, hospitals, and banks
11. Telephone towers and airports
12. Seasonal trade
13. Fuel wood supply
14. Irrigation systems

Local Observations of Impacts Across Sectors

The following categories represent the major assets of the Khumbu as defined by consultation participants. The current and potential impacts of climate change that follow are based on qualitative observations only, with little quantitative data to either support or challenge each phenomena. This is a chronic problem throughout most of Nepal's high mountain regions, which suffer from a near absence of long-term meteorological, hydrological, forest fire, and other scientific data and records. The one exception in the case of the Khumbu LAPA was the detailed information concerning Imja Glacial Lake's characteristics, growth, and stability as gathered by the HiMAP Glacial Lake Rapid Reconnaissance Team, and shared with workshop participants on a regular basis. While the contemporary and felt impacts of climate change as reported below must be treated with caution, the strong consensus for their validity among all workshop participants must also be acknowledged as well.

3.2.1 Trekking and Mountaineering

Flights between May and October are becoming unreliable to and from Lukla, primarily because of prolonged periods of cloud cover or overcast conditions that can cancel flights for a week or more at a time. If this problem continues, it could shorten the trekking and mountaineering seasons considerably and the number of trekkers and mountaineers visiting the Khumbu region may decline. Climate extremes, such as increases in windstorms and heavy snowfall, can also have direct impacts on mountaineering expeditions. If this trend continues, the Khumbu region is likely to receive fewer expeditions as climbers search elsewhere for more suitable conditions, and this could have severe impacts on the Khumbu economy and livelihoods of the local people.

3.2.2 Lodges

Erratic climatic conditions are starting to have impacts on the occupancy rate of lodges. Although lodges in Lukla face overcrowding because of the increased number of cancelled departing flights, the number of trekkers staying at lodges along the trekking trails is declining. If these current trends continue, the number of trekkers and mountaineers

in the Khumbu region is likely to decline as trekkers and mountaineers seek national parks with more reliable access. (Note: perceptions of declining overnights in lodges do not always match reality; the increasing number of lodges distributes trekkers more broadly.)

3.2.3 Lives and Livelihoods

Porters are the group of people who are most vulnerable to almost all climate-induced hazards. They are the most likely to be affected by GLOFs, landslides, heavy snowfall, and windstorms because these climate-induced hazards can destroy trails and bridges, as well as putting their lives at increased risk.

3.2.4 Transportation

Climate-induced hazards, particularly prolonged cloud cover and windstorms, are likely to affect the reliability of air transportation of food and other essential supplies. The problem with transportation is not only affecting tourism and lodges, but also development projects. It is becoming increasingly difficult to complete development projects on time due to delays in receiving construction materials, as well as the increased difficulty of reaching Lukla by air.



3.2.5 Airport

Increased cloud cover and overcast conditions are not only affecting the transportation sector, but also increasing the danger of using the Lukla airport. If this problem persists, the number of flights to Lukla is likely to decline, which will have wide implications for tourism and local livelihoods.

3.2.6 Seasonal Trade

Seasonal trade with Tibet used to be the main supplement to local incomes. Erratic climatic conditions, however, are starting to have impacts on trade; the number of traders from Tibet and neighboring villages is declining sharply. Food and other commodities are more expensive as a result, and if this trend continues seasonal trade in this region is likely to decline, or cease altogether.

3.2.7 Communication and Hydropower Infrastructure

Heavy snowfall and windstorm are likely to affect communication towers and hydropower schemes, causing major disruption in the communication network and the hydropower supply. Maintenance and operation of these services are likely to become more expensive.

3.2.8 Services

Heavy snowfall and windstorms are likely to affect hospitals, schools, and monasteries, since staff may not be able to provide their regular services. Hospitals may run out of supplies such as medicines, or may not be able to cope with the increase in patients injured or affected by different hazards.

3.2.9 National Park and Biodiversity

Forests and wildlife are most likely to be affected by windstorms, forest fires, and heavy snowfall. Monitoring and patrolling activities will be difficult, and wildlife poaching and other illegal activities may increase as a result. Climate variability may also affect native wildlife and vegetation. It may increase migration of low altitude wildlife to higher altitudes, and high alpine habitats may degrade as competition for food between immigrant and resident species increases.

3.2.10 Drinking Water

The Khumbu region is likely to experience longer periods of drought in the summer and freezing in the winter, both contributing to water scarcity. There are also other non-climatic stressors, such as pollution from leaking septic tanks or toilets situated over or near seasonal watercourses. Increases in waterborne diseases may further amplify the water scarcity problem. Water scarcity is already affecting households and particularly lodges, where there is increased demand for water because of flush toilets and showers. Agriculture and hydropower are also likely to be affected.

3.3 Step 3 — Vulnerability Assessment

To facilitate the envisioning of prospective adaptation options, participants were encouraged to form groups to discuss the results of the previous vulnerability adaptation assessment. Discussions focused on the current impacts of six priority climate-induced hazards (see below), and included assessments of their:

- a. Current impacts,
- b. Possible short-term impacts of hazards in the absence of adaptation measures, and
- c. Adaptation options that could be considered in the future to reduce risks and vulnerabilities.

The top six hazards discussed in detail included the following:

3.3.1 Glacial Lake Outburst Floods (GLOFs)

Current impacts: Recent GLOFs in the Khumbu occurred in 1977 near Pangboche and in 1985 in the Bhote Kosi valley. The 1985 Langmoche flood in the Bhote Kosi valley was the most destructive GLOF in the Khumbu's recorded history, destroying bridges, a hydropower station, drinking water systems, agricultural land, houses, and killing five people.

Possible short-term impacts: Existing lake growth is accelerating (such as Imja glacial lake)(Figure 3), as is the development of new glacial lakes (such as Ngozumpa). In the event of an Imja glacial lake outburst flood (GLOF), damage to local populations, visitors, infrastructure, and the Khumbu and national economies could be substantial (Figure 4).



Figure 3: The Imja glacial lake (top) began forming in the early 1960s, and now contains approximately 65 million cubic meters of water.

Suggested future adaptation options and measures, ranked in order of priority by participants¹:

1. Survey, research, and monitor potential GLOF sites, particularly those lakes that are at higher risk of flooding.
2. Survey safer sites for infrastructure such as water supply systems, hydropower, trails, and bridges.
3. Establish GLOF rescue and relief funds and the institutions to manage them.
4. Install a GLOF early warning system network to disseminate warning information quickly and effectively.
5. Conduct religious ceremonies (pujas) to appease the gods.
6. Schedule GLOF risk reduction training and exposure visits by experts that develop local capacities in disaster and relief operations, as well as building more resistant structures.
7. Construct more porter shelters.
8. Reduce the water levels of risky glacial lakes, including Imja.
9. Construct emergency shelters and manage them.
10. Advocate for appropriate health and life insurance packages for porters and guides.



Figure 4: In the event of a glacial lake outburst flood, downstream villages situated close to the Dudh Kosi river channel, such as Phakding above, would suffer enormous damage. The continued construction of tourist infrastructure upon previously uninhabited river terraces complicates the issue.

¹ Highly similar items have been combined from the tables presented in the complete LAPA.

3.3.2 Landslides

Current impacts: The increased frequency of landslide incidents, presumably related to changing precipitation patterns and unseasonably heavy rainfall events, are damaging forest resources, wildlife, infrastructure, trails, and bridges (Figure 5). Agricultural land and local properties have also been damaged, and in several instances lives have been lost.

Possible short-term impacts: Increased landslides will make travelling riskier. They may permanently damage trails and bridges, and alternative routes may have to be found. Settlements in landslide-prone areas may have to be relocated. New agricultural land may need to be found to replace landslide-damaged fields. Overall, landslides will have negative impacts on the livelihoods of people and may also increase risks to trekkers and mountaineers.

Suggested future adaptation options and measures, ranked in order of priority by participants:

1. Establish forest nurseries and provide tree saplings to new plantations.
2. Post signs at hazardous sites.
3. Build gabion boxes and check dams.
4. Conduct landslide awareness and risk reduction training.
5. Relocate landslide-prone villages.



Figure 5: Landslide damage at Ghat.



Figure 6: Extreme snowfall events can create added hardship for porters who often lack warm clothing, appropriate equipment, or life insurance.

3.3.3 Heavy Snowfall

Current impacts: Khumbu winters are increasingly experiencing climate extremes, such as heavy snowfall (Figure 6). Heavy snowfall can disrupt transportation systems, strand hundreds of trekkers in Lukla, increase shortages of food and other essential commodities, restrict access to hospitals, clinics and schools, and negatively affect peoples' health. It is particularly hard on livestock, which need to be sheltered and fed, and can create added hardship for porters who often lack warm clothing, appropriate equipment, or life insurance.

Possible short-term impacts: If climate extremes such as heavy snowfall continue to increase, it will have broad impacts on local economies and livelihoods. The porter, transportation, livestock, and infrastructure sectors will be at high risk. There will be an increased risk of avalanches, affecting the mountaineering sector. There will be shortages of food supplies, animal health will decline due to shortages of winter feed, and livestock populations may decline. Prices of food and vegetables will increase and agricultural production will decline due to the increased uncertainty in agricultural cycles, which may delay the ripening and harvesting of crops and vegetables. Trekking and mountaineering expeditions will find it difficult to recruit porters, as

portering may be seen as among the most hazardous of occupations.

Suggested future adaptation options and measures, ranked in order of priority by participants:

1. Improve weather forecasting systems and make the weather report easily available to trekking groups, expedition groups, and local people.
2. Raise awareness and train local people, particularly trekking guides and porters, on snow and ice travel/climbing/safety skills and risk reduction.
3. Design and demonstrate effective greenhouses, both in terms of cost and structure.
4. Design and demonstrate improved livestock sheds and increase hay and livestock feed production.
5. Conduct trials on and utilize cold resistant varieties of crops.
6. Identify sites for porter shelters and construct and equip them with communication, medical, and food supplies.
7. Establish clothing banks for porters and lobby for porter insurance.

3.3.4 Windstorms

Current impacts: Windstorms caused extensive damages in the Khumbu in 2012 in all three VDCs. Many houses were damaged, as the gale-force winds were particularly hard on roofs, many of which were ripped apart and blown away. Nearly 1,000 trees in Namche's forests were destroyed. Infrastructure, such as power poles and communication towers, was damaged. Many people suffered from coughs and colds, and crops were damaged. Flight cancellations were high between April and May and from October to January, affecting tourist arrivals. Windstorms were also detrimental to mountaineering expeditions, particularly to autumn expeditions.

Possible short-term impacts: If the current windstorm trend continues (increasing frequency and strength), a widespread loss of forest resources, biodiversity, household property, and even lives, will result. Flight cancellations are likely to increase even more than at present. The number of autumn climbing expeditions may decline, or even discontinue. Infrastructure, houses, hydropower stations, communication networks, and the transport sector will be at a higher risk. Health and safety risks of trekking and mountaineering will increase.

Suggested future adaptation options and measures, ranked in order of priority by participants:

1. Conduct windstorm awareness and risk reduction training.
2. Establish forest nurseries and increase the number and size of plantations.
3. Review mountaineering policies to ensure flexibility in decision making for climbing routes during the climbing season.
4. Develop a reliable weather forecasting system.
5. Train locals in fire fighting and equipment.
6. Change building designs to include stronger foundations and more secure roofs to reduce risks from windstorms.
7. Establish windstorm rescue and relief funds.
8. Explore and establish alternative options for transporting food supplies and other essential commodities.

3.3.5 Forest Fires

Current impacts: Until recently, incidents of forest fire in the Khumbu region have been rare; they now appear to be increasing. Forest fires occur during the pre-monsoon period, between March and June, impacting forests, wildlife, and water supplies. Forest fires intensify the problem of water scarcity, and are damaging to forest biodiversity, visibility, livestock, tourism, and humans. They create haze and decrease visibility, contributing to flight cancellations and poor mountain views for tourists. Haze is also detrimental to human and animal health.

Possible short-term impacts: If the current rate of forest fires continues, forests and biodiversity of the Khumbu region are likely to be at a higher risk. Increased flight cancellations will occur due to haze, resulting in a loss of tourist-related income and employment. Fires will also increase the likelihood of water sources drying up and other water scarcity problems. More importantly, fires will increase health and safety risks to villages and people living near forests.

Suggested future adaptation options and measures, ranked in order of priority by participants are as follows:

1. Develop a more aggressive awareness-building campaign, as well as better forest monitoring during high forest fire risk periods.
2. Cover burned areas with plantations and fence them against cattle. Identify forests that are most vulnerable to forest fires and develop fire-controlling lines.
3. Develop, train, and equip forest fire squads.

3.3.6 Floods

Current impacts: The occurrence of flash floods appears to be increasing every year, particularly in Chaurikharka VDC. Recent floods have swept away houses, agricultural land, and infrastructure such as trails and bridges. Forests have been destroyed, and wildlife and livestock killed. Floods have triggered landslides, caused soil erosion problems, and polluted water bodies.

Possible short-term impacts: Increased flooding events are likely to destroy more agricultural and forest lands and to increase the risk of property loss. Out-migration and destruction of infrastructure are likely to increase, and the tourism, transport, and service sectors will be affected.

Suggested future adaptation options and measures, ranked in order of priority by participants:

1. Build awareness and provide training on flood risk reduction.
2. Implement widespread use of gabions and check dams to protect riverbanks, villages, property, and lives, and establish plantations to protect riverbanks.
3. Install early warning systems.

3.4 Step 4 — Adaptation Plan Development

Stakeholder Identification: A Venn diagram was used to identify different organizations — governmental, non-governmental, and community groups — active in the Khumbu region. The purpose of this exercise was to analyze an organization's potential roles and responsibilities in the implementation of the Khumbu LAPA. The names of the organizations, their relationships, and their potential support toward the implementation of adaptation actions were identified during the Venn exercise.

Seven categories of stakeholders capable of playing lead roles in the implementation of the Khumbu LAPA were identified. They include:

1. Local Government Organizations include Village Development Committees (VDC) and the District Development Committee (DDC).
2. Governmental Organizations include the Sagarmatha National Park and Buffer Zone (SNPBZ), the Department of National Parks and Wildlife Conservation (DNPWC), the Yak Farm, Nepal Police and Nepal Army, the Ministry of Tourism and Civil Aviation (MoTCA), and the Department of Hydrology and Meteorology (DHM).

3. National and Local Non-Governmental Organizations include Nepal Mountaineering Association (NMA), Trekking Agencies' Association of Nepal (TAAN), Sagarmatha Pollution Control Committee (SPCC), Khumbu Alpine Conservation Council (KACC), and Red Cross.
4. International Non-Governmental Organizations include Eco-Himal, Himalayan Trust, United Nations Development Programme (UNDP), and The Mountain Institute (TMI).
5. Community-Based Organizations include Buffer Zone Management Committee (BZMC), Buffer Zone Forest User Groups (BZFUGs), User Groups (UGs), Mother's or Women's Groups, and Youth Clubs.
6. Private Organizations include hydropower companies and Telecom.
7. Other Organizations include hospitals/clinics, schools, monasteries, and the airport.

Adaptation Project Priorities: HiMAP facilitators used four criteria to rank each adaptation option identified during the Envisioning Adaptation Plan of Action process. These criteria included (a) Effectiveness (the likely success of each option at reducing risks), (b) Cost-effectiveness (whether benefits outweigh costs), (c) Feasibility (the likelihood of securing funds and technical know-how for project implementation), and (d) Potential to reach target groups (whether the option reduces risks to poor and marginalized people as well as providing direct benefits to other target groups). A scale of 1-3 was used for each criterion, with options prioritized based on ranked scores. Climate change impact and adaptation project priorities are shown below in Table 3.

Table 3: Climate Change Impacts and Adaptation Project Priorities.

1. GLOFs	
a. Research and monitoring of glacial lakes	
b. Early warning systems	
c. Disaster management systems	
d. Insurance coverage and clothing for porters	
2. LANDSLIDES	
a. Nurseries and afforestation	
3. HEAVY SNOWFALL	
a. Weather monitoring and forecasting	
b. Snow and ice management training	
c. Green/plastic house demos	
4. WINDSTORMS	
a. Public awareness building	
5. FOREST FIRES	
a. Fire fighting training and equipment	
b. Public awareness building	
c. Afforestation	

3.5 Step 5 — Integrating the Adaptation Plan into the Local and National Planning and Funding Mechanisms

The integration or “mainstreaming” of the Khumbu LAPA into wider development planning and programs represented the next step of the Khumbu LAPA. Workshop participants agreed that coordination with governmental entities would be essential for success. In fact, HiMAP staff felt that one of the most important lessons learned from the entire LAPA process was to finalize MOUs with government, national park, and other key partners prior to commencement of the community consultations, in order to facilitate later funding and mainstreaming (see Section 5, Lessons Learned). Results from the post-consultation with government entities are nevertheless shown below:

Coordination with the VDC: The Khumbu region has two VDC secretaries, one responsible for the Khumjung/Namche VDCs and the other for

Chaurikharka VDC. Neither were available to meet nor participate in the LAPA consultations for reasons that remain unclear.

Coordination with the DDC: Consultations with DDC officials and district-based line agencies were held in Salleri between 19-26 March, 2014; and from 6-11 November, 2014. The purpose of the meetings was to understand each office’s current plans and programs in the Khumbu, as well as the roles that each could potentially play in the implementation of the Khumbu LAPA. In November, 2014, the DDC provided an official letter of commitment to include the Khumbu LAPA in its next fiscal year program, as well as expressing its appreciation for TMI’s efforts toward the Khumbu LAPA’s development and integration into regional programs.

Integration into the Sagarmatha National Park Management Plan: The National Trust for Nature Conservation (NTNC) commissioned a team in 2013 to prepare management plans for six mountain national parks, including SNPBZ. During February to March 2014, the HiMAP team held three meetings with the NTNC and their consultants to incorporate LAPA climate change adaptation options into the 2014/15 to 2018/19 SNP Management Plan. The SNP Management Plan is the main document that guides both the National Park and Buffer Zone activities over a five-year period.

Integration into the Buffer Zone Programs: Within the SNP Management Plan is the Buffer Zone work plan and budget. The Buffer Zone Fund, used to finance community development programs, is derived from park entrance fees. Consultations with SNP and BZ officials were held in September, 2014 to identify overlaps within the Khumbu LAPA and BZ activities as listed in the SNP Management Plan.

3.6 Step 6 — Implementing the Plan

The SNP Management Plan contains six programmatic themes: (1) Operation, (2) Buffer Zone, (3) Tourism, (4) Culture, (5) Institutional Development, and (6) Research. In the current plans, these themes are further divided into 43 sub-heads with 273 activities. The Khumbu LAPA programs include 33 priority adaptation activities under six priority climate-induced hazards that include (1)

GLOFs, (2) Heavy Snowfall, (3) Windstorms, (4) Landslides, (5) Forest Fires, and (6) Floods.

In collaboration with SNP and BZ authorities, a final set of community consultations in Ghat, Namche, Thame, and Khumjung was held between 20-24 September, 2014. Objectives of the consultations included:

1. Sharing the final Khumbu LAPA for feedback,
2. Identifying overlaps between the SNP, BZ and Khumbu LAPA action plans, and
3. Agreeing on the next steps required for the implementation of overlapping Khumbu LAPA and SNPBZ Management Plan activities.

Workshop participants reported that the Khumbu LAPA is a useful document in terms of both understanding the impacts of climate change as well as the various adaptation options available to reduce potential risks. They agreed with the key findings of the LAPA, stating that the six climate-induced hazards identified in the document well reflect the current situation in the Khumbu. They also commented that the plan is easy to understand and that they will have no problem implementing it, provided there are sufficient resources.

In terms of overlap, participants were given copies of the proposed five year budgets from the SNP Management Plan and Khumbu LAPA priority activities, and asked to compare and review program activities, overlaps, and gaps. Out of the 33 activities identified as priority adaptation options in the Khumbu LAPA, participants identified 26 as overlapping with activities contained within the SNP Management Plan. These included 11 SNP activities under the LAPA priority headings of GLOFs; 3 under Heavy Snowfall; 3 under Windstorms; 3 under Landslides; 4 under Forest Fires; and 2 under Floods. While some of these activities or adaptation options will be financed using BZ funds, other activities, such as the development of a community based early warning system and lowering of Imja lake by at least 3 meters, will be funded by the UNDP's Community-Based Glacial Lake Outburst Flood Risk Reduction Project (CFGORRP). Additionally, the recent and catastrophic Everest avalanche (18 April, 2014) and

snowstorm in western Nepal (14 October, 2014) that resulted in so many tragic fatalities underscored the importance of developing better insurance policies for trekking staff, as well as better management systems to ensure trekker and staff safety. Organizations such as Porters Progress, TAAN, and NMA were identified as the entities best positioned to fund and pursue these activities. Likewise, DHM, SNP, and BZ authorities will be approached with requests for the establishment of better weather forecasting facilities. These and other new adaptation priorities identified since the previous community consultations were captured in discussions focused on next steps.

4.0 STEP 7 – NEXT STEPS AND LAPA MONITORING

Workshop participants determined that the priority next steps required to accomplish LAPA activity implementation goals included the following:

- Prepare a list of priority adaptation options that were not included in the SNP Management Plan, and present them at the next planning meetings.
- Start immediate implementation of activities that have been included in the SNP Management Plan, such as the installation of signs at vulnerable landslide sites.
- Contact DHM authorities to explore the possibility of installing reliable weather monitoring and forecasting systems.
- Request SNP to start providing reliable weather forecasts to trekkers and climbers at check posts.
- Request the SNP, BZMC, VDCs, DDC and other potential donors to support activities identified in the Khumbu LAPA but not included in the SNP Management Plan.
- Develop a monitoring and evaluation system that includes activities, indicators of success, means of verification, and responsible parties so that the effectiveness of implemented activities can be monitored, and changes incorporated if needed (TMI staff are in the process of preparing such a plan for the Khumbu LAPA that stakeholders can use for the foreseeable future).
- Request SNP and the BZMC to coordinate activities to reduce duplication of effort.
- Conduct a planning meeting that includes all VDC representatives, members of the BZMC, and NP staff so that effective LAPA/SNPBZ Management Plan planning and implementation processes can be established.

5.0 CONCLUSIONS AND LESSONS LEARNED

Nepal began promoting the use of Local Adaptation Plans for Action (LAPA) in 2011, and HiMAP's experiences in the development and implementation of the Khumbu LAPA have represented significant contributions to the process. The Khumbu LAPA was the result of extensive and elaborate consultations, meetings, and workshops. It involved over 300 participants from a wide range of stakeholder groups, including governmental, non-governmental, and community organizations. The resulting LAPA plan represents a first but major step in the ability of local people in the Khumbu to understand, evaluate, and adapt to the impacts of climate change upon their high mountain environments and lifestyles.

A number of important lessons learned can be isolated from the LAPA experience that include the following:

5.1 Community Consultation Processes are Expensive and Time Demanding

The HiMAP team found that community consultations in high altitude, remote, road less regions such as the SNP require extensive time and funding. Access to the SNP also proved to be highly vulnerable to climate change, as the increase in cloudy days means that flights are cancelled on a regular basis, sometimes for weeks at a time. Many inexperienced people find that living and working in conditions at high altitudes are extremely uncomfortable, if not dangerous or even lethal. LAPA and fieldwork methods and approaches should be streamlined in remote areas to produce shorter, more cost-effective processes and timely results, while also respecting the requirements for health and safety. Logistics, travel, in-country leadership, and resources should all be assessed at the beginning of the project to determine the most effective and realistic time line for project activities.

5.2 Build Formal Relations with Government and Community Partners at the Beginning of a LAPA Program

Formal Memoranda of Understanding (MOUs) with government partners (e.g., DNPWC, SNPBZ, DDC, and VDC) may be required as part of any long-term partnership or as part of a LAPA implementation process. These should be obtained or be in process prior to commencement of LAPA consultations and plan development. Each partner's roles, responsibilities, and funding commitments should be clearly understood to avoid misunderstandings and delays. MOUs and partnership building with governments at the beginning of the LAPA process are also excellent ways to facilitate later funding mechanisms for identified adaptation priorities.

5.3 Establish Trust and Partnerships with all Stakeholders

The establishment of trust and communication with governments and communities is critical to the process of successful LAPA development and implementation. As co-manager of the HiMAP project, TMI's decades long record of participatory project implementation in the Khumbu was fundamental to community acceptance of both the glacial lake research work and LAPA consultations. Regularly sharing the results of on-going field investigations; understanding local perceptions and priorities; incorporating local knowledge into field investigations and plans; understanding community-desired levels of risk and safety; and understanding the cultural setting of the problems identified should be standard components of any climate change project. In remote mountain regions such as the Khumbu, project staff should also be posted to the field site during the LAPA process in order to maintain open communications, share information, and ensure continuity of the program.

5.4 Integrate Development into the LAPA Process

Unlike other LAPAs in Nepal, the Khumbu LAPA began with an assessment of local development issues and needs in order to place climate change within the broader development context. The identification of important development sectors, from trekking to trade to hydropower, and the impacts of climate change upon each, facilitated the later identification of adaptation options and plans for action.

5.5 Use Larger Geographical Units

Because of socio-economics, culture, and climate change similarities between all three VDCs (Chaurikharka, Namche, and Khumjung) inside the park and buffer zone, the Khumbu LAPA considered the entire SNPBZ as the collective planning unit. This integrated and comprehensive approach was felt to be more effective and efficient in the development of a climate change adaptation plan for the Khumbu region. The use of larger geographical units may not be appropriate for other regions, however, and adequate assessments should be conducted prior to the launch of the community consultations.

5.6 Incorporate Scientific Data

“Science-driven, community-based development” is a fundamental component of the HiMAP approach. The Khumbu LAPA attempted to incorporate available scientific data and knowledge to verify or challenge local experience and perceptions of climate change impacts and vulnerabilities. In the end, the lack of climatological, hydrological, geomorphological, and other data for the region prevented any definitive comparisons between the two. The exception was the regular provision of results from the concurrent Imja glacial lake investigations, which suggested that the lake was more dangerous than previously thought. The availability of this information may have influenced community ranking of GLOFs as the number one hazard in terms of risks and impacts, despite a high level of local skepticism during the first years of HiMAP activities (2011-2013).

5.7 Build In-Country Capacity

The glacial lake research at Imja lake was an excellent opportunity to build the capacity of the Department of Hydrology and Meteorology (DHM), Kathmandu University, and Tribhuvan University by supporting the participation of staff, professors, and graduate students in the bathymetric, Ground Penetrating Radar (GPR), glacial retreat, and other studies carried on between 2012 and 2014. Project budgets should earmark sufficient funds at the beginning of the project cycle to permit this in-country involvement, which can provide some of the most effective training and capacity building available. Affiliations with DHM and other governmental entities charged with field research also help to build trust between the government and local stakeholders. As mentioned in section 5.2 above, formal relations and MOUs with in-country government, scientific, and university entities should be part of a climate change project's start-up activities.

5.8 Share Data and Information

Although HiMAP enjoyed excellent relationships with all stakeholders (i.e., local communities, DNPWC, UNDP, etc.), providing the raw data from the bathymetric and GPR field surveys to DHM marked a turning point in the strengthening of the relationship between the two groups. Within reason, when research is funded by the U.S. government, data should be considered to also be the property of the host government, and not necessarily that of the sub-contractors. The relationship with DHM was also strengthened by the pro bono training provided to staff in accessing and analyzing data from the Imja lake project. Working proactively with UNDP, including hosting the first Imja Lake Risk Reduction Partners Workshop, regular sharing of LAPA results, and provision of project handbooks and publications, also facilitated an atmosphere of trust that was of benefit to all project stakeholders.

5.9 Include a Media and Outreach Component in Project Design

Efforts to publish project results in the peer reviewed literature should be made, particularly since climate change adaptation experiences in high

mountain regions are so poorly documented and represented. Short videos of the LAPA community consultations and integrated field studies proved to be one of the best ways to rapidly convey important project messages to most stakeholders (e.g., local communities, donors, USAID/Washington, scientists). To reach the US public, different storyboards may be needed that place greater emphasis on telling the story first and briefly mentioning the project and donor at the end.

5.10 Nurture the Community of Practice

HiMAP's Community of Practice (CoP) needs to engage members in day to day activities beyond the

Nepal/Peru workshops and small grants. In the past year, we followed a number of lessons learned from the Mountain Forum, which TMI established in the mid-1990s. That is, the moderator was someone with a solid international reputation and credibility as a mountain specialist. That person then actively engaged members on an almost a daily basis by, for example, asking them for (a) permission to post a recently published paper, (b) to write a short summary of their current research interests, and/or (c) to write up the preliminary results of a recent expedition, including photos. This results in a CoP perceived as having value, in this case as a mechanism to get one's work and accomplishments better publicized, they tend to grow by word of mouth.



REFERENCES

- Adaptation Partnership 2012. Andean-Asian Mountains Global Knowledge Exchange on Glaciers, Glacial Lakes, Water & Hazard Management. Proceedings. Washington, DC: High Mountains Adaptation Partnership.
- Bird, N. 2011. The Future for Climate Finance in Nepal. ODI – Capacity Development for Development Effectiveness Facility in Asia and the Pacific. Kathmandu: Unpublished report prepared for UNDP and Government of Nepal.
- Byers, A.C., McKinney, D.C., Thakali, S., and Somos-Valenzuela, M.A. 2014. The High Mountains Adaptation Partnership (HiMAP): Promoting Science-Based, Community-Driven Approaches to Climate Change Adaptation in High Glaciated Mountain Ranges of the World. Geography. In press.
- CARE, WWF, and USAID 2011. Climate Vulnerability and Capacity Analysis and Community Based Plan of Action; April 2011; Dadheli Community Forest User Group, Kalikhola VDC Wards 1-4, Taplejung. Report. Kathmandu: CARE.
- CARE, WWF, and USAID 2010. Climate Vulnerability and Capacity Analysis and Community Based Plan of Action, Lelep Community Forest User Group, Lelep VDC Ward No. 3; Lelep Village, Taplejung. Report. Kathmandu: CARE.
- Climate Adaption Design & Piloting – Nepal project team with inputs from CBVA and DCEP project teams, 18 August 2011. The LAPA Framework: Local Adaptation Plan of Action: Summary of Key Steps and Key Actions. Kathmandu: unpublished report.
- Government of Nepal, 2011. LAPA Manual, Local Adaptation Plan of Action (LAPA) Manual. Kathmandu: Ministry of Environment, Singh Durbar.
- Karki, G. and Regmi, B. 2012. Local Adaptation Plan of Action Discussion Paper. Kathmandu: unpublished report.
- LEAD Newsletter 297: 19-21st December 2012. Local Adaptation Plan of Action (LAPA) development and consultation workshop in Muzaffargarh, Punjab www.lead.org.pk.
- McDowell, G., Ford, J., Lehner, B., Berrang-Ford, L., and Sherpa, A. 2012. Climate-related hydrological change and human vulnerability in remote mountain regions: a case study from Khumbu, Nepal. Springer-Verlag: Reg Environ Change.
- Ministry of Environment 2010. Climate Change Vulnerability Mapping in Nepal. Kathmandu: Government of Nepal.
- Paudel, N.S. 2010. Responding to Climate Change in a Transitional Politics - Review of political context in relation to designing LAPA in Nepal. Report: prepared for CAPD- Nepal.

- Peniston, B. 2013. A Review of Nepal's Local Adaptation Plans of Action (LAPA). Report. Kathmandu: The Mountain Institute.
- Portocarrero, C., 2013. The Glacial Lake Handbook: Reducing Risk From Dangerous Glacial Lakes in the Cordillera Blanca, Technical Report, B. Armstrong, G. Anderson, A. Byers, M. Cote, J. Harlin, and D. McKinney (eds.), High Mountains Adaptation Program, United States Agency for International Development, Washington D.C., 2014.
- Regmi, B. and Subedi, R. 2012. The LAPA Process. Tiempo Climate Cyberlibrary (on- line publication).
- Rupantaran Nepal 2012. Consolidating Learning of Local and Community-based Adaptation Planning: Implications for Adaptation Policy and Practice. Kathmandu: Unpublished report prepared for Livelihoods and Forestry Project (LFP), Interim Forestry project (IFP) and Rupantaran Nepal.
- Sagarmatha National Park Management Plan (2014/15-2018/19), 2014, Review and Update Protected Area Management Plan, the Development Management Institute, Kathmandu (draft)
- Somos-Valenzuela, M.A., McKinney, D.C., Rounce, D.R., and Byers, A.C. 2014. Changes in Imja Tsho in the Mt. Everest Region. The Cryosphere, 8, 1–27, 2014 www.the-cryosphere-discuss.net/8/1/2014/ doi:10.5194/tcd-8-1-2014
- Upreti B.K and Bhattarai, T.N. 2011. Adaptation to Climate Change, NAPA to LAPA. Document produced by UK Department of International Development (DFID)-funded Climate Change and Development Knowledge Network project. Kathmandu: Government of Nepal, Ministry of Environment.
- United States Agency for International Development (USAID) 2014. Climate-Resilient Development: A Framework For Understanding And Addressing Climate Change. Washington, DC: Global Climate Change Office, Climate Change Resilient Development Project.

U.S. Agency for International Development

1300 Pennsylvania Avenue, NW

Washington, DC 20523

Tel: (202) 712-0000

Fax: (202) 216-3524

www.usaid.gov